

Downturn LGD: flexible and regulatory consistent approaches*

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Abstract

To identify the downturn LGD, an essential role is played by the banks: they have to determine the business cycle used to find the possible negative relation between default and recovery rates. To attain regulatory validation, the methodological framework has to be accurate, sustainable and applied to qualitative robust databases. The simplicity of integration of the downturn corrective in the estimates, also for managerial purposes, should not be overlooked. Starting from multivariate structural models of economic series, it is possible to derive an identification process for the impacts of the extracted business cycle on the recoveries and on the determinants of danger rates used to recalibrate the insolvency definition to the regulatory framework. The result is a proposal of organic, modular approach, that led to the production of regulatory coherent LGD estimates.

1. Introduction

An extremely important element in the recent debate on loss given default (LGD) is the progressive overcoming of the classic assumption of independence between that rate and probability of default (PD) that still characterizes the Basel II regulatory framework. Several empirical studies¹ have found that, in presence of recessive phases (downturns) characterized by higher default rates, the values of recovery rates (complement to the unit of the LGD) are significantly lower because of the reduction of counterparts' asset value. Therefore, it appears to manifest an inverse correlation between recovery rates and the systematic risk of the economy. This evidence has important consequences for a correct estimate of credit risk capital requirements. The models that assume independence between PD and LGD do not appear adequate, systematically leading to underestimate the necessary capital in adverse macro-economic conditions and to emphasize pro-cyclical effects already embedded in the regulatory models². These empirical findings have resulted, from a regulatory point of view, in the introduction within that framework³ of the concept of downturn LGD (DLGD). Such DLGD is used in the regulatory functions to obtain prudential estimates of absorbed capital. The Bank of Italy attributes to the banks the responsibility of the determination of business cycle and of the connected recessive phases. It is necessary to demonstrate that the systematic risk of the economy has to be considered within the "relevant factors" that influence the LGD expected values. The bank must certify the inverse relation between default and recovery rates by mean of specific analyses based on historical data.

* This article contains only the opinions of the authors and not of the companies with which they serve. The article was written and revised jointly by the two authors. The paragraphs can however be divided by core competency as follows: 1st, 2nd Salis, 3rd, 4th & 5th Turri, 6th & 7th jointly.

¹ Cfr. e.g. Altman *et al.* (2005); Hu and Perraudin (2002)

² Altman, Resti and Sironi (2002)

³ Cfr. Banca d'Italia (2006, Titolo II, Parte Seconda, Sez.. IV, Par.2.3)

In the Italian banking context, the most widespread methodology for estimating LGD is based on an actuarial approach (workout LGD – discount of all the cash flows registered from the passage to default to the closing of the position). Beyond the technical difficulties related to the preparation of the data set for the estimates, we underline that LGD values deriving from such methodology can naturally be far away from the punctual situations of the business cycle. This is especially true in a context, like that Italian one, characterized by lengthy recovery procedures .

An additional element of complexity in the Italian context is derived from the peculiar difference of default definitions used in the development of the LGD models. For this purpose, recovery data on non-performing loans (typically “an absorbent” state) are commonly used, since they are often characterized by greater reliability and temporal depth with respect to data on “less extreme” and “reversible” states of default (i.e. the so called “incagli” – watchlist loans - and the 180 “not technical” past dues). The LGD estimates based on non-performing loans are usually recalibrated using appropriate danger rates, that on one side express the probability to fall into insolvency in a state of default “less absorbent” and from the other side measure the probability to come back “in bonis” from that state. The use of danger rates involves the necessity to verify punctually, in the spirit of the Regulation, the existence of an inverse relation between the bank’s danger rates level and a series of factors - some of which variable in relation to the course of the economy (at a general or sector level). Furthermore, in the estimation of the DLGD it is important to consider the recessive conditions that are relevant for the estimation of danger rates. We can hence conclude that the DLGD estimate can be seen as a combination of a DLGD estimated on bad loans (or bad loans and watchlist loans if the we have sufficient data), and an estimation of a downturn danger, DDR.

A bank that wants to develop a LGD system potentially coherent with the Regulation in terms of DLGD, has to understand his positioning regarding the above mentioned issues. The solution will be bank-specific and the level of complexity dependent from the available information. In the decision, a key role will be played by the methodology adopted for the identification of recessive phases. During this current persistent period of economic crisis, also the role of the internal validation function in the identification process of a DLGD regulatory compliant is crucial. This function has to verify, independently from the model development function, the conservativeness and the soundness of different methodological choices made. A pivotal requirement for an effective validation analysis is the availability of a rigorous and complete documentation, that contains all the development phases of the methodological framework. For instance, the rationale for the definition of an appropriated recessive phase for each homogenous portfolio of activity, or the statistical analyses for the identification of a possible inverse relation between default and recovery rates must be described. Moreover, the determination of the operating modalities used to incorporate the downturn effect in the workout LGD estimates, the external (i.e. the historical series of

macroeconomic factors) and internal data sets (i.e. the internal recovery rates for customer's segment, technical form, ...) utilized must be clear. It is even appropriate to mention the external benchmarks underlying the assumption of key choices (i.e. market parameters for the calculation of an interest rate spread adjusted for the downturn effect).

After discussing some issues concerning the discount of the historical flows of recoveries in a workout LGD perspective (par. 2), we will present a methodology (par. 3) to build an index for the business cycle (i.e. creation of a synthetic indicator to identify the recessive phases). Moreover, we will verify the correlation effects between default and recovery rates, taking into account also danger rate models (par. 4). In paragraph 5, an organic, modular, manageable and upgradeable framework to produce LGD estimates will be defined. Eventually, we will outline some useful considerations in order to lead an accurate internal validation analysis (finalized to test the regulatory compliance of the methodological choices adopted) and a few critical remarks about pro-cyclical effects potentially inherent in the regulatory definition of DLGD (par. 6).

2. The workout approach

The workout LGD discounts the recovery cash flows, without the recovery costs and without the eventual increases of the exposure at default. A widespread choice among the Italian banks is to discount flows by use of the long term rates structure (EURIBOR/IRS) referred to the month and year of passage to default (backward looking solution) or, alternatively, to the moment of LGD model estimation (forward looking solution).

From a strictly regulatory point of view, the Regulation seems to request that discount rate has to include an opportune add-on (a spread-over-market-risk) for the recovery risk implicit in the exposition⁴. In order to derive a workout "downturn" LGD, it appears possible to include in the spread-over-market-risk a risk premium component for the coverage of the recessive phases. As a matter of fact, a higher volatility of the observed and expected yields is then found. For instance, if we estimate - through G.A.R.C.H. models - the relation between the market index volatility and the risk premium, it's possible to determine some prudential corrections of the risk premium, in comparison with the higher volatility embedded in the recessive phases. In such a way, the DLGD is given from the discounting of the cash flows using the new rate. This methodological approach does not explicit a direct link with the business cycle, because it does not include explicative variables in the model but defines the adverse cycle effect on the recoveries basing

⁴ Banca d'Italia (2006, Titolo II, Parte Seconda, Sez. IV, Par.2): "... il calcolo del valore attuale deve riflettere sia il valore monetario del tempo sia il rischio insito nella volatilità dei flussi di recupero mediante l'individuazione di un premio al rischio adeguato; solo in assenza di incertezza nel recupero (ad esempio se i recuperi provengono da depositi in contanti) il calcolo del valore attuale può riflettere il solo valore monetario del tempo" ["... the actual value must reflect both the monetary value of time and the risk of volatility of the flows by mean of an appropriate risk premium. Only in absence of uncertainty over recoveries (e.g. when they come from cash deposits) the actual value can reflect just the very value of time"]

only on market indices, through the observation of their volatility. From a methodological point of view, we prefer more flexible solutions respect to the one proposed above.

3. Identifying a reference business cycle

The study of business cycles necessarily starts from their measurement and the definition of different phases. The well known definition of Burn and Mitchell (1946) define the business cycle as composed by “expansions occurring at about at the same time in many economic activities, followed by similarly general recessions, contractions and revivals which merge into the expansion phase of the next cycle”. This sequence of changes is recursive but not periodical. Thus there are two main characteristic: first, the presence of similarities in the dynamic of the series; second the continuous reversibility of economic fluctuations, even if not at exactly precise intervals. The very presence of these co-movements implies that to correctly define the cycle we must jointly examine different economic series. Furthermore we reveal that the proposed definition specifies the exact nature of the economic fluctuations, but nonetheless the movements in economic activity may take diversified duration and characteristics. Theoretically is possible to distinguish between long-period (structural) components and short (medium)-period ones. The latters are, strictly speaking, the cycles we are looking for. Practically, for Burn and Mitchell the distinction was still cumbersome due to the lack of adequate techniques to separate them.

Starting from the '60s, following a period of pronounced and uninterrupted trend of growth in the main economic variables, a wide set of techniques were developed to extract those components from the series. That has led to new definition of business cycles in terms of deviations from a specified trend – the so called deviation cycle – or in terms of movements around a growth rate – the so called growth cycle. Anyhow starting with the works of Beveridge and Nelson (1981) and Nelson and Plosser (1982) the cycle was more precisely defined as the residual part of a time series after the extraction of a permanent component (stochastic or deterministic). While the trend represents the non-stationary component, the business cycle is constrained to stationarity, moving around its long period equilibrium level.

All those premised, to correctly analyze the business cycle is essential to have long and sound time series (e.g. quarterly or monthly ones). For instance data from Istat and Bank of Italy may be used, grouped according to the following drivers of analysis⁵:

- Macroeconomic variables related to the Italian economic system (household consumption, gross fixed investments, labour units, wages, GDP, Value Added, Industrial production index, etc.)
- Market variables related to the credit system (default rate for loan facilities⁶, etc.)

⁵ Similar to the distinction found in Querci (2007; p.177).

⁶ The so called “Tassi di decadimento”.

The objective is the identification of an appropriate representative index of the business cycle. From a general point of view we refer to Burns and Mitchell for its main features:

- It must reflect the co-movements of different and economic relevant time series.
- It must show a tendency to revert (even if not at constant intervals) to a long-period value.

We can conduct the analysis in two distinct phases:

1. A univariate study of the specific time series features is conducted, by structural models⁷.
2. Afterwards an analysis for the identification of a "common reference cycle" is pursued by mean of a multivariate extension of the previous approach⁸.

This framework builds upon concepts of spectral analysis and the so-called Butterworth filters, by achieving a time series decomposition based over different captured frequencies. The construction of those decomposition filters tries to target to different results:

- An ideal filter characterized by a gain function that is shaped as an index function over a selected band of frequency.
- A filter that is able to recover stochastic components that are meaningful from an econometric point of view and useful for forecasting.

It's not always easy to pursue the correct balance between these two objectives, that are in contrast among themselves; as a matter of fact, to obtain the perfect approximation of ideal filters stochastic components with high order of integration are needed. Nevertheless, this is in contrast with the "common-sense" of econometricians and economists that regards trends of order higher than two or integrated cycles as unrealistic.

Butterworth filters allow the extraction of both the trend and the cycle from a time series. That is shown in Graph 1, where we find the **low-pass filter**, that extracts the low frequency movements, and the **band-pass filter**, that separates the average frequencies, typically characterizing the business cycle⁹.

Limiting for sake of simplicity our argument to already seasonally adjusted time series¹⁰, it's possible to break the series in factors in the following way¹¹:

$$y_t = \mu_{m,t} + \psi_{n,t} + \varepsilon_t \quad \varepsilon_t \sim NID(0, \sigma_\varepsilon^t) \quad t = 1, \dots, T \quad (1)$$

⁷ Look at Harvey (1989), Harvey and Trimbur (2003), and Pelagatti (2004).

⁸ Or, as the regulator impose, more reference cycle indexes distinct for the main class of counterparts/exposures that characterize the activity of the financial intermediary.

⁹ The high frequency components are summarized into the disturbs, and, for time series not seasonally adjusted, in possible seasonal terms.

¹⁰ But the result is obviously extendible by proper seasonal components.

¹¹ The software STAMP™ (by OxMetrics™) has been used for the elaborations. It allows a univariate and multivariate structural time series analysis. We refer to Koopman & al. (2007) for the statistic exposition here briefly summarized. To this text we refer also for further in-depth analysis regarding SUTSE multivariate models.

where $\mu_{m,t}$ is a stochastic trend (with deterministic level and stochastic slope), $\psi_{n,t}$ is the stochastic cycle and ε_t is a white noise; m and n are the trend and cycle order corresponding to the order of the low-pass filter and the order of the band-pass filter.

The stochastic trend component is specified as:

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t \quad \eta_t \sim NID(0, \sigma_\eta^2) \quad (2)$$

$$\beta_t = \beta_{t-1} + \zeta_t \quad \zeta_t \sim NID(0, \sigma_\zeta^2) \quad (3)$$

where β_t is the slope (gradient) of the trend μ_t (a facultative component) and $\varepsilon_t, \eta_t, \zeta_t$ are mutually uncorrelated white noises. By the assumption of a fixed level, in (2) η_t is null, due to $\sigma_\eta^2 = 0$.

The stochastic cycle component is specified as:

$$\begin{bmatrix} \psi_t^{(n)} \\ \psi_t^{*(n)} \end{bmatrix} = \rho_\psi \begin{bmatrix} \cos \lambda_c & \sin \lambda_c \\ -\sin \lambda_c & \cos \lambda_c \end{bmatrix} \begin{bmatrix} \psi_{t-1}^{(n)} \\ \psi_{t-1}^{*(n)} \end{bmatrix} + \begin{bmatrix} \kappa_t \\ \kappa_t^* \end{bmatrix} \quad t = 1, \dots, T \quad (4)$$

where (n) is the cycle order; ρ_ψ , with $0 < \rho_\psi \leq 1$, is the damping factor; λ_c is the frequency, in radians, in the range $0 \leq \lambda_c \leq \pi$; κ_t and κ_t^* are two mutually uncorrelated NID disturbances with zero mean and common variance σ_κ^2 . The period of the cycle, one of the factors of utmost interest in our decomposition of the time series, is set to $2\pi / \lambda_c$.

Consistently to economic logic, the parameters regarding the order of integration of the low-pass filter and pass-band filter are so fixed:

- $m = 2$, for the trend (i.e. an integrated random walk)
- $n = 2$, for the cycle (i.e. a stochastic cycle of 2nd order)

Only where was considered appropriate (usually in cases with possible high frequency cycles), a $m=1$ trend (random walk) was used in order to guarantee that the pass-band filter hold back also a part of the frequencies that are typical of long-period cycles. The business cycles of interest usually identify fluctuations in the range of 1.5-8 years, which correspond to power spectrum in the interval $[0.20\pi; 1.05\pi]$. Cyclical behaviour outside this range, whenever detected, is considered not relevant for our ends.

After the univariate analyses is possible to jointly examine the characteristics of the discovered cycles. First, we proceed by mean of homogeneous sub-categories of variables. Second, we thoroughly investigate the connection among the most interesting variables. Thus doing we come from a long-list to a short-list of significant variables that stand for inclusion in a reference cycle index.

For the second stage of multivariate analysis is possible to use SUTSE (Seemingly unrelated time series equations) models. They present a logical structure quite similar to the one already examined for the univariate case. However, here there is a vector of observations dependent by unobserved components vectors. The different series examined are linked by the correlations of their disturbances. Given a set of economic time series, it's particularly interesting the possibility to extract a cycle (or more cycles) with similar characteristics: the same frequency, λ_c , and the same damping factor, ρ . These cycles are called "similar cycles". Furthermore, the disturbance correlation matrix can be less than full rank (so called "common factors model") thus reducing the numbers of parameters that must be estimated and simplifying the derivation of results. The identification of a common cycle among time series (i.e. the discovery of different cycles exactly proportional) has the natural interpretation of a synthetic index representative of the business cycle derived by the underlying factors.

In order to reduce the complexity of the problem and the relating information processing time, in the multivariate analysis we limited our focus to the joint consideration of the variables that the univariate stage pointed out as relevant. Nevertheless, we maintained a limited number of time series for each area of economic/financial meaning.

In a first stage we conducted a similar cycle analysis without imposing "ex-ante" common cycles, but just a few constraints over the disturbance matrix of the trend and seasonal component. In a second stage, having discovered by the unconstrained analysis the emergence of a natural common cycle, we repeated the process of model derivation by imposing in advance the constraint of a common cycle presence.

Alternative models were estimated for different exposure classes. Yet they revealed not to be significantly different from a general one (Graph 2). Thus, for sake of simplicity, we adopted that one as the "reference cycle". The variable INDEXCYCLE shows for the Italian economy a behaviour well in line with most of the empirical external evidences and identifies 7 recessionary periods of different intensity: ...-1990(3); 1992(2)-1993(3); 1995(3)-1996(4); 1998(1)-1999(2); 2001(1)-2002(3) ; 2004(1)-2005(1); 2007(2)-....

4. Does exist an inverse correlation between default and recovery rates?

Given a reference cycle, we proceed to identify a possible inverse relation between defaults and recovery rates¹². More generally speaking we examine the links between the different phases of the business cycle and the level of historically observed LGD. We identify the main idiosyncratic factors that influence LGD within multivariate models. Most of them are categorical ones, thus suggesting the use of generalized linear models for the analysis of variance. Consistently with the normative rules on the correct definition of default to be used in the estimate of risk factors, we have hence extended our analysis to include in LGD also less absorbing state of default as the so-called “incaglio” (watchlist loans) and past due (over 180 days). Starting from a direct estimate on a historical sample of “sofferenze” (non-performing loans), we later extended it by mean of multivariate models explaining danger rates.

Then, for each model, the possible impact of downturns on the variance of the target variable was tested. Only the residuals of models with idiosyncratic factors were considered. For instance, the relation between LGD of “sofferenze” in specific periods and the correspondent phase of business cycle (recession vs. growth) was closely examined. Three solutions have been explored:

- First, as in previous studies, the association was based on the opening date of default. Nevertheless, it appears doubtful that, due to the long-lasting length of recovery process in Italy, the macroeconomic conditions present at the opening of default are strictly linked with recovery rates.
- Second, the association was based on the quarter during which the last movement on the position was observed. This appears sensible since often most recoveries are concentrated in the last observed movements before the closing of the position.
- Third, we determined a “barycentre of recoveries” for each position. From specific movements in the sample an average delay respect to the opening date was determined and weighted by the recovered amounts on the position.

The analyses were done in the three ways¹³ to make results on macro-economic conditions impact more sound and documented.

To verify the existence of significant differences in LGD values during recession and growth we first used test for independent samples to compare the values of the residuals from a regressive model with only idiosyncratic factors. Since these residuals are often non-normal we used non-parametric tests¹⁴. Then, also

¹² Cfr. Banca d'Italia (2006, TIT. II, Parte seconda, SEZ.IV, par.2.1)

¹³ Anyhow for the danger rates models only the first and second way of association were possible.

¹⁴ Mann-Whitney, Moses, Kolmogorov-Smirnov to compare LGD levels during recession and growth. Kruskal-Wallis to analyse the differences among specific phases of the business cycle (periods defined by using the previously determined reference cycle)

the intensity of the cycle phase was tested by mean of a direct regression with INDECYCLE as explicative factor: first only on the residuals of previous regression, second (when significant) directly in a revised model with both idiosyncratic factors and the systemic factor.

Generally speaking we can conclude that most of LGD variability is explained by counterpart or credit line specific factors. In comparison the macroeconomic factors – when significant - have a more limited effect in absolute term. Even if cannot be denied that the inclusion of INDECYCLE in the models, whereas statistically significant, led to great R^2 improvements in relative terms. For example, according to the methodological framework of the next paragraph (Graph 3) we found that the inclusion of the reference cycle index among the predictors led to the following R^2 relative increments compared to correspondent models with only idiosyncratic factors: 17.3% in (A), 2.8% in (F), 7.0% in (G) and 23.6% in (O). For all that a prudential inclusion of INDECYCLE in the model is wise, whereas it turns out to be significant and with a coefficient consistent with regulator's expectations. This done a DLGD may be easily derived by replacing the historical value of reference cycle with a synthetic measure of its value during picked out recessions. For example:

- we can distinguish 2 phases of the cycle, recession and growth, and set an appropriate percentile (e.g. 25°) of the INDECYCLE in the recessive phases as a reference value to substitute into the models;
- otherwise we identify 4 phases: “growth under the trend”, “growth above the trend”, “recession under the trend” and “recession above the trend”; then we fix the value for DLGD estimate to the average or median one observed during “recession under the trend” phases.

Both methodologies appear in line with regulator's suggestions without leading to overly prudential corrective factors that may improperly affect the estimates (cfr. paragraph 6 for further investigation on this problem)¹⁵.

5. A modular scheme for LGD

The study of the connection between recovery rates and default rates in the Italian economic environment has a peculiar element of complexity: the difference of the normative definition of default from the concept commonly used when estimating LGD models. Here the choice is often for the use of discounted cashflows of credits in “sofferenza” (typically an irreversible state), a narrower concept than the Basle 2 one (that comprises also “incagli” and past due loans).

¹⁵ For the themes of paragraphs 3 and 4 see also Turri (2008).

Commonly these LGD estimates are discounted by appropriate “danger rates”, that express (1) the probability to enter into default in a less absorbing state than “sofferenza” and (2) the non-trivial probability to exit from this condition without losses.

The most common methodologies for the use of danger rates identify corrective values that are distinct by exposure (e.g. Retail vs. SME/Corporate; or internal class ones) and other few idiosyncratic factors. A fix reference matrix of corrective values is estimated and used. At the best of our knowledge there are no in-depth studies that try to study the possible impact of macroeconomic factors on these corrective values. Nevertheless is straightforward from the normative that for a correct DLGD estimate these danger rates must be also submitted to this type of examination. As we have done for recovery rates on narrow definition of default, we need to test the impact of the business cycle (recessions in particular) on danger rate estimates. Whereas a significant link is found, macroeconomic variables (or the synthetic INDEXCYCLE) must become predictors for danger rates models. If we overcome the fix matrix approach and develop a more model based solution¹⁶, the attainment of a “downturn danger rate” follows a process similar to the one already described.

Thus the whole system for LGD estimation that is here proposed (Graph 3) integrate a typical workout LGD derived from recovery data on “sofferenze” and a series of models to determine appropriate counterpart-specific and credit-specific danger rates¹⁷. These allow getting back to the normative definition of default.

When a statistically significant correlation between the target variable and the state of the economy was found, the INDEXCYCLE factor was inserted among the predictors.

The analysis revealed a significant impact of the business cycle both for the component derived from the data on non-performing loans, and for some of the components of danger rates models. In the end, thus we can speak both of a downturn LGD (on non-performing loans) and of downturn danger rates.

6. The downturn LGD as a regulatory tie: different point of views and open issues

As a consequence of the economic-financial crisis, the Bank of Italy attribute a great importance to all the stress testing activities that the banks has to lead in order to take conscience of the real dimension of their capital requirement. At the moment in the E.U. it is open the debate on the quantification of a potential capital add-on to take as reserve to coverage recessive economic phases.

¹⁶ With use of generalized linear models for producing estimates of the different components of the danger rates.

¹⁷ The system is highly modular. First an extension to “incagli” - comprehensive also of “sofferenze rettificate” (adjusted-non performing loans) and restructured loans - is done and next a further one to past due loans.

One of the most common ways to reach this goal, is to identify and quantify this capital surplus working on risk parameters: the inputs of the regulatory capital function (PD, EAD and LGD). Even if, from a strict interpretation of the Regulation, Bank of Italy request to the banks to stress the PDs and to the control functions to verify the robustness of the adopted methodology, the conservativeness of the scenarios and the underlying hypotheses of correlation, in the definition of the process of downturn LGD calculation, the Regulator also states that “the adverse economic conditions may coincide with those adopted for the conduction of the stress testing”¹⁸. Thus, a strict link between PD stress testing and downturn LGD is set. The underlying regulatory idea is to guarantee a greater coherence between the various framework of calculation of Basel 2 risk parameters. Moreover, we observe that the potential capital savings connected to the passage from the Foundation approach (with regulatory LGD at 45%) to AIRB Method (with LGD internally estimated) are mainly depending from LGD component, because of the shape of the regulatory capital curve (Gordy curve). In fact, while the PD enters not linearly in the calculation (it is an input of the cumulative distribution function of losses and of the correlation) and therefore its variation involves a mediated impact on capital, on the contrary the LGD is introduced linearly. Thus any LGD reduction involves the same proportional effect in terms of smaller capital absorption.

Such thematic was also discussed in a meeting between the Bank of Italy Governor and the main bankers of the system. In such context (Bank of Italy, 2009), among the several arguments dealt (with a specific focus on the strategies of patrimonial strengthening), the big attention that the Regulator attributes to the impact of various stress scenarios on the banks’ expected losses has been confirmed. The hypothetical scenarios are divided in a base one, in which we register the expected losses embedded in the banks’ portfolios (with a LGD of 35%) and three adverse, with higher losses (with a LGD of 45%).

Given the remarkable impacts in terms of patrimonial absorptions that a not precautionary downturn LGD estimate could involve, in our opinion it is very important the role carried out by an independent function (i.e. the internal validation unit) in the monitoring phase of the conservativeness and robustness of the various methodological choices made up under development. Often such activity is much more difficult because of a methodological documentation not always complete.

Before carrying out the controls on the various steps of determination of the downturn effects and of their incorporation in the workout LGD model, it is essential to make a serious analysis of data quality on the inputs of the calculation model. Usually the workout LGD models are based on the cash flows (recoveries and costs) registered on the positions closed in a non-performing loan status. This choice could

¹⁸ Banca d’Italia (2006, Titolo II , Cap. I , Sez. IV).

simplify the analyses respect to situations in which the developer decide to use also the cash flows regarding watchlist loans (“incagli”) and the 180 days past dues. As a matter of fact, in these latter cases the variety and complexity of the IT procedures to investigate greatly complicate the verification activities. In our personal experience - that reflects the history of the majority of the Italian banks - the presence of merging among banks has rendered these controls extremely articulate and laborious, also because reduction costs’ problems have prevented a rigorous data storing of closed positions at the moment and/or before the merging.

The choice commonly used to estimate a LGD model on position closed in “sofferenza” and to recalibrate it on default status “less absorbent” (“incagli” and 180 days past dues) involves a LGD reduction that, in some way, could be partially counterbalanced from the downturn component (the idea underlying is not so far from that expressed during the meeting among Italian bankers and the Regulator). However often this does not happen, partially because of the practical difficulties to determine a robust correlation between default and recovery rates, basing on historical series not always reliable and sometimes incomplete. Thus, still a problem of data quality! For us, a crucial role in the development phase of a compliant LGD model is the dimension and the quality of the dataset. As an example, it is difficult to answer positively to the Regulation when it request “to define an appropriate recessive phase for every homogenous portfolio within each jurisdiction” because often we have not the data separated for each portfolio (i.e. there could be a lack of data concerning the regulatory segmentation of the PD) or for jurisdiction (e.g. the details of the economic sectors) because of information not always separable. Whereby possible, as in the approach introduced in par.3, the development of alternative models for different customer’s segments does not take always results meaningfully different from the baseline (not subdivided for segments).

The proposed methodological solution is very interesting for two reason:

- first, the modality of determination of the economic cycle, through the utilization of many explicative variables (macroeconomic and market variables). The focus only on a unique macroeconomic variable (i.e. G.D.P. or a variable not properly “macro” as Bank of Italy default rate) could involve potential “bias” in the identification process of the cycle;
- second, it is interesting the application of the correlation analyses of the dependent variables not only on “bad loans” positions but also on danger rate models.

Concerning the analyses of the eventual inverse relation between default and recovery rates, the relevant problem is connected to the definition of the temporal lag between the cyclical phase and the loss rate

that, usually for non-performing loans, is based on the observation of the recoveries registered in a multi-annual temporal span.

At the moment, even in the absence of a universally accepted solution, the approach introduced at par. 4 seems the best because it tries to draw conclusion on the subsistence of such relation not just focusing on a unique default-loss matching rule, but investigating some alternatives. In particular the last proposed rule (that starting from book/extra-book keeping movements concerning the development sample try to determine, for each position, the average delay of the recoveries from the opening of the non-performing loan position) appears the most compliant from a regulatory point of view.

Often, even very articulate methodologies do not allow detection of a "strong" connection between loss rates and the state of the business cycle by using the available historical time series. First, indeed, it is necessary to find a statistic significance of the link between macroeconomic variables / conjuncture synthetic indices and target variables (taking into account appropriate confidence levels, due to the often small dimension of the samples). Second however, and not least, question arises for which levels of explained variance of the total historically observed recovery variance (or the behavior of the specific objective variable, in the event of the models of danger rates), the impact effect on the final LGD estimates could be considered really "substantial". As a matter of fact, we recall that, because of the peculiar bimodal distribution of the recoveries, the level of variance explained by the commonly utilized models is generally low. Which additional contributions to the variance explained by a model with cycle-related explicative variable can be ignored without incurring into serious distortions of the "correct risk quantification"? Which basic components (look at the modular scheme illustrated in par. 5) of the final LGD are impacted by macroeconomic variables in a significant and sufficiently intense way? The solution of the problem is not trivial. It is necessary to make considerations on appropriate reference metrics to define the contribution of explanatory variables in relation with the cycle and also, more generally, on the opportunity cost of investment for development and maintenance of complex models.

On the one hand it is true that the regulator, for failure in the detection of significant relationships of recoveries with the business cycle, allow for calculating DLGD as a weighted average of the long-term observed loss rates. However, on the other hand, we must observe that this translate into a *de facto* return of the econometric model to logics that are closer to a simpler look-up table.

The approach to Basel 2 DLGD and its potential pro-cyclical and anti-cyclical aspects deserve some further consideration, in light of ongoing discussions between the supervisors. Once verified the correlation, the proposed solution leads to an increase in capital levels during growth phases. Nevertheless, the introduced cyclical effect is largely asymmetrical. In fact, also in recessions showing intensity equal or smaller than that

implicitly introduced by the downturn corrective corresponding capital reserves will not be released. By way of explanation let us consider Graph 4 based on real data.

The horizontal line is representative of a level of INDEXCYCLE set for the downturn corrective. The above curve is instead the reference cycle historically observed and expected in future periods. The descending sections of the curve, below the zero value, represent recessions, those ascending stages of growth. Adding the position in relation to the null value (i.e. the level of the trend of the Italian economy) the four cases already stated at the end of par. 4 arise. For values of the reference cycle (observed or estimated) above the line of the historically applied downturn level, effects of capital allocation in excess of actual needs occur, both in case of phases "above the trend", and in case of phases "under the trend". Only particularly negative cyclical phases (with INDEXCYCLE levels below the corrective reference value) can generate an anti-cyclical effect in the application of DLGD. Problematic is the role of the adopted rule in phases "under the trend" where excess capital allocation takes place. In particular, there is the risk of pro-cyclical effects of acceleration of the recessions and slowdown of the phases of recovery.

Overall, placing the corrective to levels representative of the most pronounced recessions (such as that just observed) could exacerbate the effects introduced by the pro-cyclical prudential supervisory framework by compounding the initial credit crunch and slowing down the next recovery. Conversely, inadequate levels of the corrective expose banks to unduly underestimate the actual risk faced in times of severe economic crisis, and to face risk of competitive crowding out compared to competitors that do not use models of DLGD during the positive phases of the cycle.

So we focus on the delicate problem of determining the appropriate level of the downturn corrective. To date, this do not find in the consolidated operating practices and regulatory guidelines a solution that balances among the need for systemic stability, anti-cyclicity and a fair competitive positioning of the banking players. There seems therefore more robust and viable, in a regulatory view, a methodological solution within the First pillar (such as those outlined in this paper). This one, subject to the verification of statistical significance, should incorporate in the econometric estimates of LGD also explanatory variables (or a synthetic indicator) that 'catch' in some way the presence / absence and relative intensity of a recessionary period. Nevertheless, then, the actual (or forecasted) values of macroeconomic variables should be used instead of the prudential downturn values (as mentioned in par . 4). This choice would have secure benefits, such as improvements of the reliability of the risk-adjusted pricing of credit.

Would remain instead open the possibility to compare these estimates with those obtained in case of adoption of DLGD in the context of stress testing and, more generally, of the Second Pillar. There, if the case, by using different levels of conservativeness that take into account, for instance, the lending policies

and the combination of other risks to which the intermediary is subject. At that time you could quantify any over-allocation of internal capital during good times and moderately negative phases. You could also try to assess the possible margins of freed capital of the phases under the reference level of the downturn corrective. This latter anti-cyclical function could even be directly modulated by the Supervisory Authority within the SREP assessment.

7. Conclusions

We have seen how the supervisory authority, in relation to the issue of DLGD, suggests banks to independently identify the appropriate reference business cycle, before proceeding against such a benchmark to verify the real impact of adverse cyclical conditions on the level of recoveries. The level of autonomy granted to the bank requires the search for a methodological framework for accurate analysis. This must be combined in an appropriate level of complexity and comprehensibility in compliance with specific regulatory constraints. Furthermore, it must produce a final solution for LGD consistent with management needs. Internal and external data bases of proven quality should support the analysis.

The use of structural models for multivariate analysis of macroeconomic time series (SUTSE) seems to provide an efficient and easily upgradeable solution to the problem of identifying the reference cycle and for the quantification of its intensity.

As for the check of the impact of recessionary conditions of the business cycle on the levels of LGD, it's easy to use a synthetic index (derived using SUTSE models): the INDEXCYCLE. This stands as its proxy and become the candidate explanatory variable to explain the observed variability of recoveries or the objective variables that are alternatively used in the danger rate models (these used to standardize the definition of insolvency to the regulatory one).

Faced with a clear and replicable operational plan, which covers the direct integration of a synthetic indicator in macroeconomic models to estimate the rate of loss in case of insolvency, the main problem seems to remain the third condition imposed by the Bank of Italy. It is not easy to determine a correct threshold for the level of significance needed for deciding whether to incorporate the corrective downturn in the models or, on the contrary, continue to use weighted averages of the long-term observed loss rates.

While the statistical significance of the assumed relationship can often be detected, the more uncertain is the “substantiality” of the effect, in relation to the problem of proper quantification of risk. Conservative choices may suggest including the downturn effects in the estimates. In this case, however, problems of defining the appropriate level of correction introduced remain open. These can lead to very different

solutions in terms of capital absorption, thereby generating potential adverse pro-cyclical effects and an unfavourable competitive position for the bank.

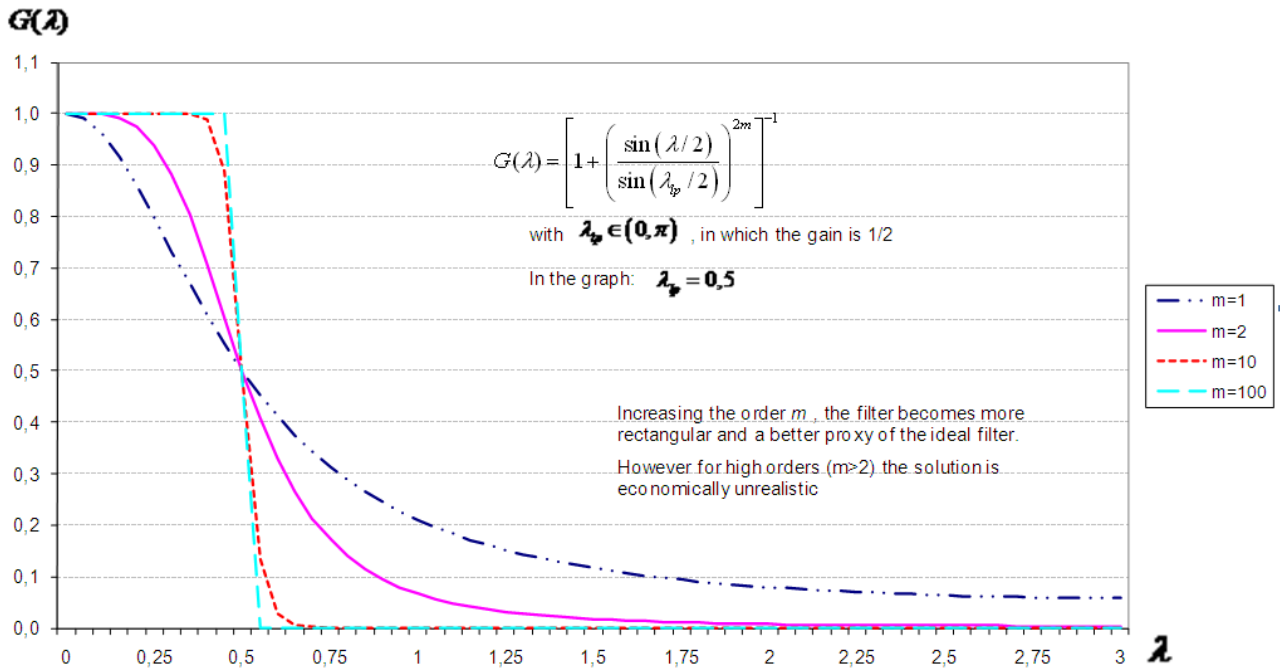
Therefore, in the absence of clearer regulatory guidance over the "minimal level of substantiality" for the correlation effect for binding inclusion in a DLGD scheme, it seems to emerge a situation that leads us to suggest, in a pure First Pillar view, the adoption of explanatory models possibly sensitive to the cycle, but not directly linked to average reference prudential values. The anti-cyclical management of the estimates of capital by any additional capital buffer could be left to the stages of stress testing and ICAAP (Second Pillar). In any case, that is now supported by a unique and consistent framework for LGD analysis.

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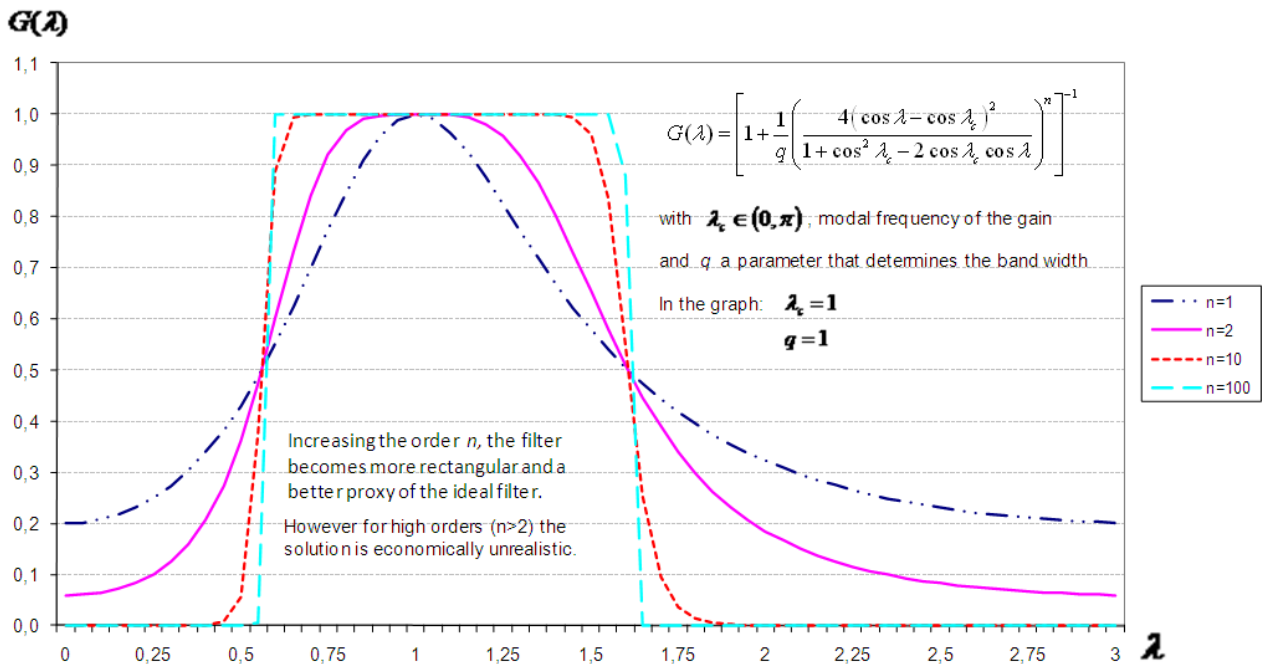
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Graph 1 –Butterworth filters: low-pass and band-pass

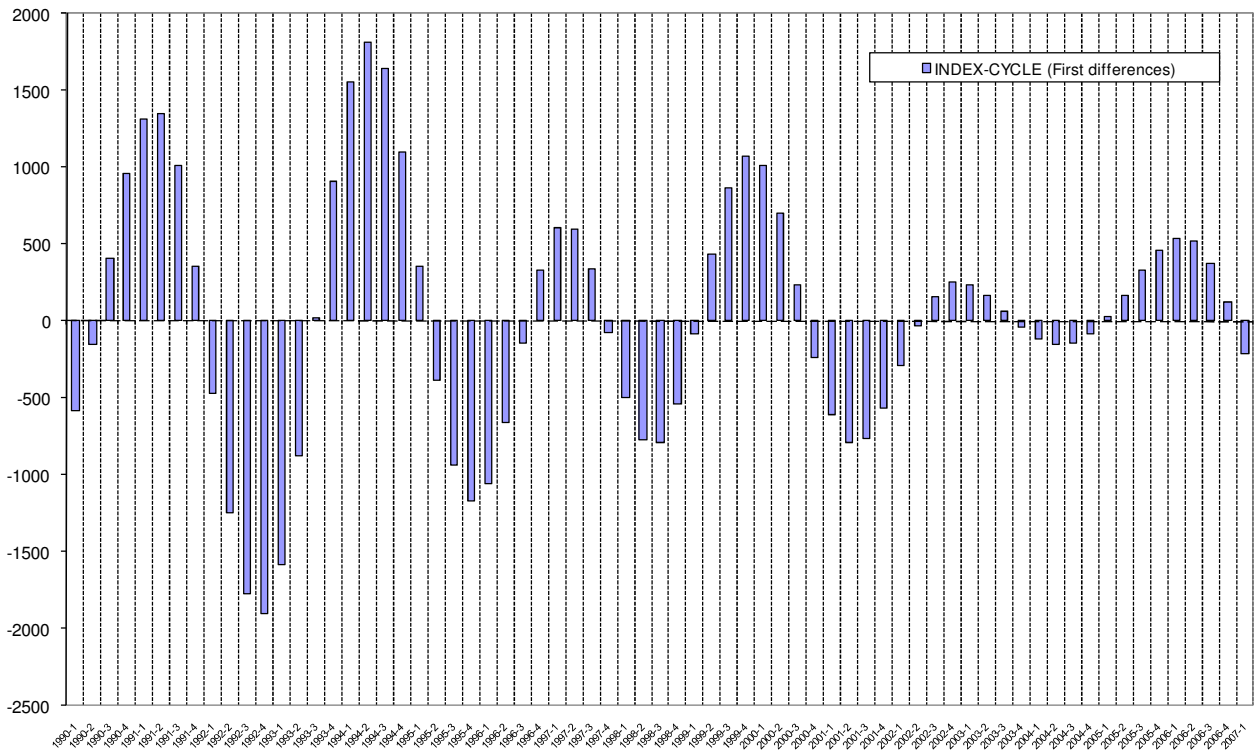
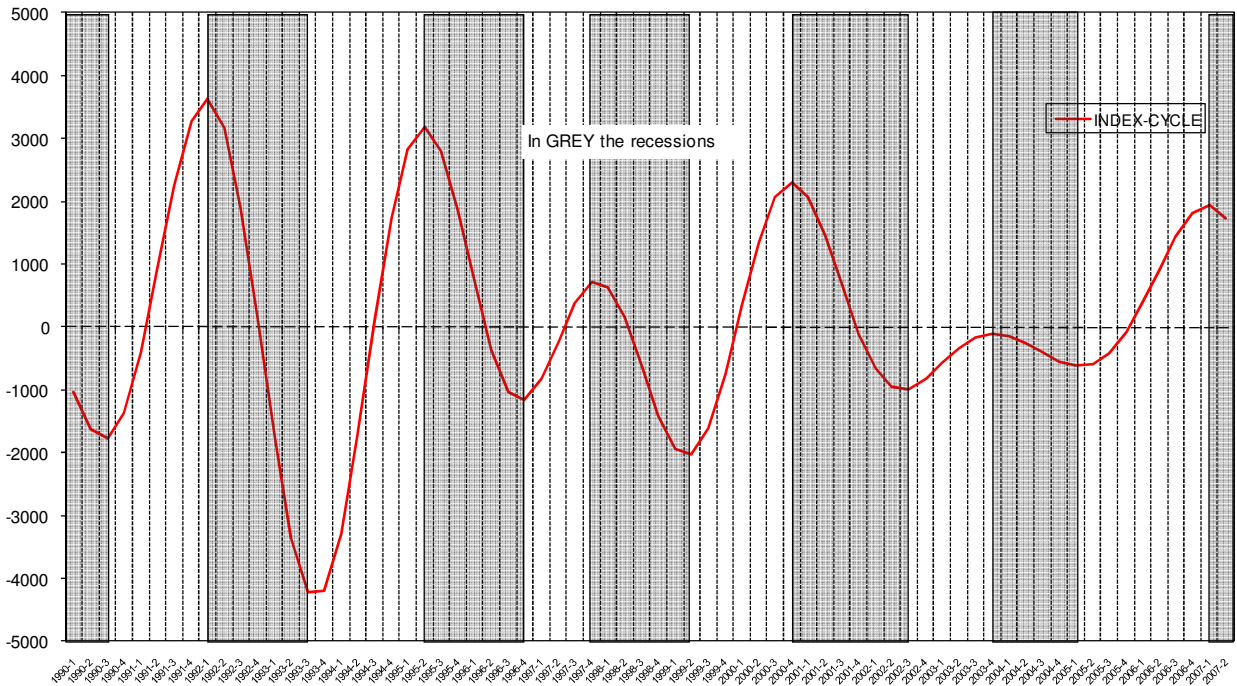
Low-pass filter



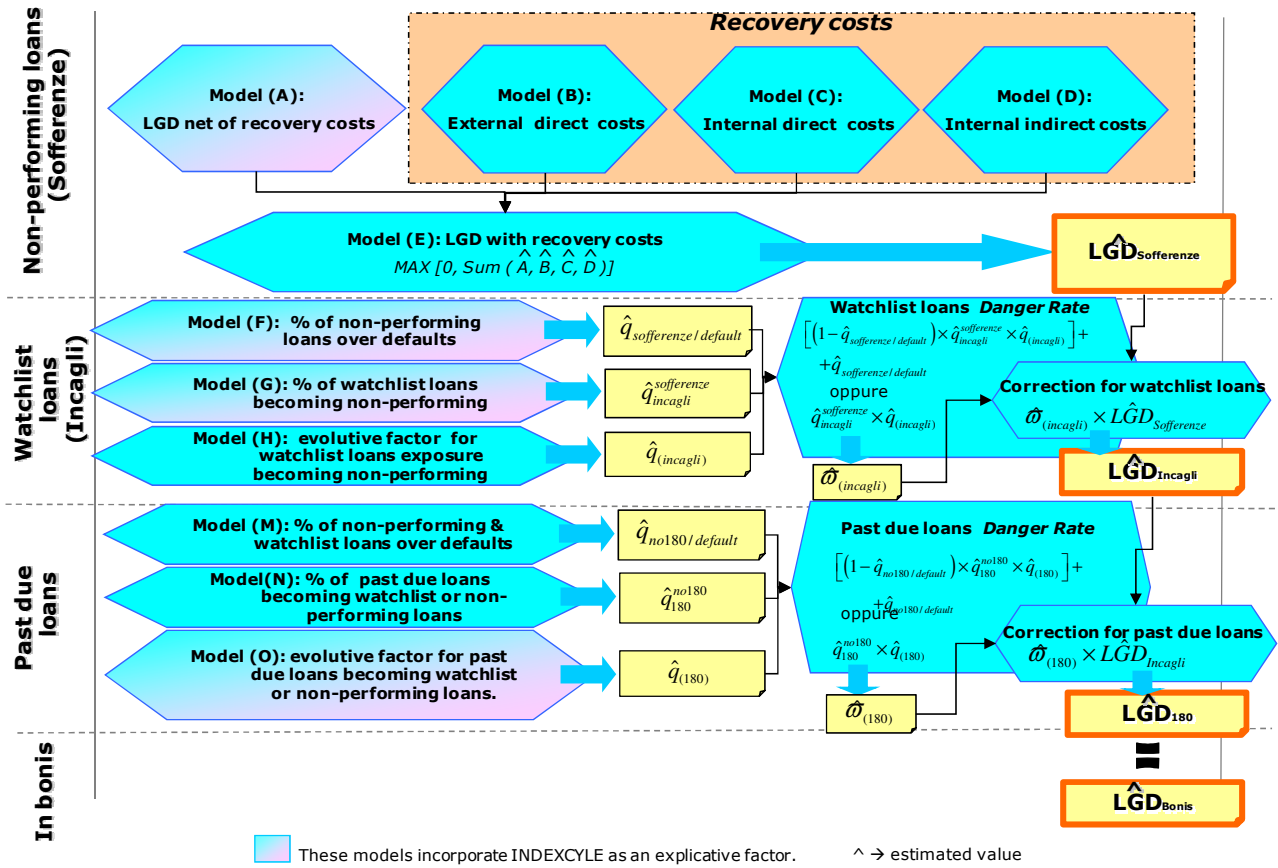
Band-pass filter



Graph 2 - SUTSE models: *common cycle* as a reference index for business cycle



Graph 3 – A flexible scheme for LGD estimates



Graph 4 - Reference cycle and downturn corrective factor

